

Practitioner's Docket No. AP9472

PATENT

TRANSMITTAL LETTER TO THE U.S. DESIGNATED OFFICE (DO/US)--
ENTRY INTO THE U.S. NATIONAL STAGE UNDER CHAPTER IPCT/EP99/06236

25/Aug/1999

25/Aug/1998

INTERNATIONAL APPLICATION NO.

INTERNATIONAL FILING DATE

PRIORITY DATE CLAIMED

Method of Operating a Brake Assistant System

TITLE OF INVENTION

Oliver Hecker, Steffen Ritz

APPLICANT(S)

Box PCT
Assistant Commissioner for Patents
Washington D.C. 20231
ATTENTION: DO/US

NOTE: *The completion of those filing requirements that can be made at a time later than 20 months from the priority date results from the Commissioner exercising his judgment under the authority granted under 35 U.S.C. § 371(d). The filing receipt will show the actual date of receipt of the last item completing the entry into the national phase. See 37 C.F.R. § 1.491, which states: "An international application enters the national stage when the applicant has filed the documents and fees required by 35 U.S.C. § 371(c) within the periods set forth in § 1.494 and § 1.495."*

WARNING: *Where the items are those that can be submitted to complete the entry of the international application into the national phase subsequent to 20 months from the priority date, the application is still considered to be in the international stage. And if mailing procedures are utilized to obtain a date the express mail procedure of 37 C.F.R. § 1.10 must be used (because international application papers are not covered by an ordinary certificate of mailing. 37 C.F.R. § 1.8(2)(xi)).*

CERTIFICATION UNDER 37 C.F.R. § 1.10*

(Express Mail label number is mandatory.)

(Express Mail certification is optional.)

I hereby certify that this paper, along with any document referred to, is being deposited with the United States Postal Service on this date 04/25/2000, in an envelope as "Express Mail Post Office to Addressee," mailing Label Number EL489900794US, addressed to the: Assistant Commissioner for Patents, Washington, D.C. 20231.

Joyce Krumpe

(type or print name of person mailing paper)

Joyce Krumpe

Signature of person mailing paper

WARNING: *Certificate of mailing (first class) or facsimile transmission procedures of 37 C.F.R. § 1.8 cannot be used to obtain a date of mailing or transmission for this correspondence.*

***WARNING:** *Each paper or fee filed by "Express Mail" must have the number of the "Express Mail" mailing label placed thereon prior to mailing. 37 C.F.R. § 1.10(b).*

"Since the filing of correspondence under § 1.10 without the Express Mail mailing label thereon is an oversight that can be avoided by the exercise of reasonable care, requests for waiver of this requirement will not be granted on petition." Notice of Oct. 24, 1996, 60 Fed. Reg. 56,439, at 56,442.

(Transmittal Letter to the United States Designated Office (DO/US - Entry into National Stage under 35 USC 371--page 1 of 7)

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WARNING: Documents and fees must be clearly identified as a submission to enter the national stage under 35 U.S.C. § 371, otherwise the submission will be considered as being made under 35 U.S.C. § 111. 37 C.F.R. § 1.494(f).

WARNING: Failure to pay the national fee within 20 months from the priority date will result in the abandonment of the application. The time for payment of the basic fee is not extendable. M.P.E.P. § 1893.01(f)(1), 6th ed., rev. 3.

1. Applicant herewith submits to the United States Designated Office (DO/US) the following items under 35 U.S.C. 371:

- a. This express request to immediately begin national examination procedures (35 U.S.C. § 371(f)).
- b. The U.S. National Fee (35 U.S.C. § 371(c)(1)) and other fees (37 C.F.R. § 1.492), as indicated below:

2. Fees

CLAIMS FEE	(1) FOR	(2) NUMBER FILED	(3) NUMBER EXTRA	(4) RATE	(5) CALCULATIONS
*	TOTAL CLAIMS	1 -20=		x\$ 18.00=	\$
	INDEPENDENT CLAIMS	1 --3=		x\$ 78.00=	
MULTIPLE DEPENDENT CLAIMS(S) (if applicable) + \$260.00					
BASIC FEE**	The international search fee, as set forth in § 1.445(a)(2) to be paid to the US PTO acting as an international Searching Authority:				
	<input type="checkbox"/> has been paid (37 CFR 1.492(a)(2)).....\$760.00 <input type="checkbox"/> has not been paid (37 CFR 1.492(a)(3)).....\$970.00 <input checked="" type="checkbox"/> where a search report on the international application has been prepared by the European Patent Office or the Japanese Patent Office (37 CFR 1.492(a)(5)) \$840.00				
SMALL ENTITY	Total of above Calculations				
	Reduction by ½ for filing by small entity, if applicable. Affidavit must be filed also. (note 37 CFR 1.9, 1.27, 1.28)				
	Subtotal				
	Total National Fee				
Fee for recording the enclosed assignment document \$40.00 (37 CFR 1.21(h)). (See Item 10 below). See attached "ASSIGNMENT COVER SHEET (37 CFR 3.34)".					
TOTAL	Total Fees enclosed				
\$840.00					

(Transmittal Letter to the United States Designated Office (DO/US - Entry into National Stage under 35 U.S.C. 371--page 2 of 7)

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*See attached Preliminary Amendment Reducing the Number of Claims.

****WARNING:** "To avoid abandonment of the application, the applicant shall furnish to the United States Patent and Trademark Office not later than the expiration of 20 months from the priority date; *** (2) the basic national fee (see § 1.492(a)). The 20-month time limit may not be extended." 37 C.F.R. § 1.494(b).

- i. A check in the amount of \$ _____ to cover the above fees is enclosed.
- ii. Please charge Account No. 18-0013 in the amount of \$ 840.00.

A duplicate copy of this sheet is enclosed.

WARNING: If the translations of the international application and/or oath or declaration have not been submitted by the applicant within twenty (20) months from the priority date, the applicant will be so notified and given a period of time within which to file the translation and/or oath or declaration in order to prevent abandonment. The payment of the surcharge set forth in § 1.492(e) is required as a condition for accepting the oath or declaration later than twenty (20) months after the priority date. The payment of the processing fee set forth in § 1.492(f) is required for acceptance of an English translation later than twenty (20) months after the priority date. Failure to comply with these requirements will result in abandonment of the application. The provisions of § 1.136 will apply. 37 C.F.R. § 1.494(c).

3. A copy of the International application as filed (35 U.S.C. § 371(c)(2)):
 - a. is transmitted herewith.
 - b. is not required, as the application was filed with the United States Receiving Office.
 - c. has been transmitted
 - i. by the International Bureau. Date of mailing of the application from form PCT/IB/308): _____.
 - ii. by applicant on _____.
Date

NOTE: Section 1.494(b) was amended to require that the basic national fee and a copy of the international application must be filed with the Office by 20 months from the priority date to avoid abandonment. "The International Bureau nominally provides the copy of the international application to the Office in accordance with PCT Article 20. At the same time, the International Bureau notifies the applicant of the communication to the Office. In accordance with PCT Rule 47.1, that notice shall be accepted by all designated offices as conclusive evidence that the communication has duly taken place. Thus, if the applicant desires to enter the national stage and applicant has received notice from the International Bureau, applicant need only pay the basic national fee by 20 months from the priority date." [This can now be paid subsequently with a surcharge.] Notice of Jan. 7, 1993, 1147 O.G. 29 to 40, at 35.

4. A translation of the International application into the English language (35 U.S.C. § 371(c)(2)):
 - a. is transmitted herewith.
 - b. is not required as the application was filed in English.
 - c. was previously transmitted by applicant on _____.

Date

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5. [] Amendments to the claims of the International application under PCT Article 19 (35 U.S.C. § 371(c)(3));

NOTE: *The Notice of January 7, 1993 indicates that 37 C.F.R. § 1.494(d) was "amended to clarify the existing practice that PCT Article 19 Amendments must be submitted by 20 months from the priority date, which time may not be extended." This Notice further advises: "Of course, the failure to do so does not result in loss of the subject matter of PCT Article 19 amendments. The applicant may submit that subject matter in a preliminary amendment filed under Section 1.121. In many cases, filing an amendment under Section 1.121 is preferable since grammatical or idiomatic errors may be corrected."* 1147 O.G. 29-40, at 35. See item 11(c) below. See also 37 C.F.R. § 1.494(d).

- a. [] are transmitted herewith.
- b. [] have been transmitted
- i. [] by the International Bureau. Date of mailing of the amendment (from form PCT/IB/308): _____.
 - ii. [] by applicant on _____.
Date
- c. [] have not been transmitted, as
- i. [] no notification has been received that the International Search Authority has received the Search Copy.
 - ii. [] the Search Copy was received by the International Searching Authority, but the Search Report has not yet been issued. Date of receipt of Search Copy from form PCT/ISA/202): _____.
 - iii. [] applicant chose not to make amendments under PCT Article 19. Date of mailing of Search Report (from form PCT/ISA/210): _____.
 - iv. [] the time limit for the submission of amendments has not yet expired. The amendments, or a statement that amendments have not been made, will be transmitted before the expiration of the time limit under PCT Rule 46.1.
6. [] A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. § 371(c)(3));
- a. [] is transmitted herewith.
 - b. [] is not required as the amendments were made in the English language.
 - c. [] has not been transmitted for reasons indicated at point 5(c) above.
7. [x] An oath or declaration of the inventor including power of attorney (35 U.S.C. § 371(c)(4)) complying with 35 U.S.C. § 115
- a. [] was previously submitted by applicant on _____
Date
 - b. [] is submitted herewith, and such oath or declaration
 - i. [] is attached to the application.
 - ii. [] identifies the application and any amendments under PCT Article 19 that were transmitted as stated in points 3(b) or (c) and 5(b); and states that they were reviewed by the inventor, as required by 37 C.F.R. § 1.70.

iii. [x] will follow.

II. Other document(s) or information included:

8. [x] An international Search Report or Declaration under PCT Article 17(2)(a):
- [x] is transmitted herewith.
 - [] has been transmitted by the International Bureau. Date of mailing from form PCT/IB/308): _____.
 - [] is not required, as the application was searched by the United States International Searching Authority.
 - [] will be transmitted promptly upon request.
 - [] has been submitted by applicant on _____.
Date
 - [] is not transmitted, as the international search has not yet issued.
9. [x] An Information Disclosure Statement under 37 C.F.R. §§ 1.97 and 1.98:
- [x] is transmitted herewith.
Also transmitted herewith is (are)
[x] Form PTO-1449 (PTO/SB/08A and 08B)
[x] Copies of citations listed
 - [] will be transmitted within THREE MONTHS of the date of submission of requirements under 35 U.S.C. § 371(c).
 - [] was previously submitted by applicant on _____.
Date
10. [] An assignment document is transmitted herewith for recording. A separate
[] "COVER SHEET FOR ASSIGNMENT (DOCUMENT) ACCOMPANYING NEW PATENT
APPLICATION" or
[] FORM PTO—1595
is also attached.
- [] Please mail the recorded assignment document to:
- [] the person whose signature and address appears below.
 - [] the following:
11. [x] Additional documents
- [] Copy of request (PCT/RO/101)
 - [x] International Publication No. WO00/10852
 - [] Specification, claims and drawing
 - [x] Front page only
 - [x] Preliminary amendment (37 C.F.R. § 1.121)
 - [] Other

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12. The above checked items are being transmitted
- a. before the 18th month publication.
 - b. after publication and the article 20 communication, but before 20 months from the priority date.
 - c. after 20 months (revival).

NOTE: *Petition to revive (37 C.F.R. § 1.137(a) or (b)) is necessary if 35 U.S.C. § 371 requirements are submitted after 20 months*

13. Certain requirements under 35 U.S.C. § 371 were previously submitted by the applicant on _____ namely:
Date

AUTHORIZATION TO CHARGE ADDITIONAL FEES

WARNING: *Accurately count claims, especially multiple dependent claims, to avoid unexpected high charges if extra claims are authorized.*

NOTE: *"A written request may be submitted in an application that is an authorization to treat any concurrent or future reply, requiring a petition for an extension of time under this paragraph for its timely submission, as incorporating a petition for extension of time for the appropriate length of time. An authorization to charge all required fees, fees under § 1.17, or all required extension of time fees will be treated as a constructive petition for an extension of time in any concurrent or future reply requiring a petition for an extension of time under this paragraph for its timely submission. Submission of the fee set forth in § 1.17(a) will also be treated as a constructive petition for an extension of time in any concurrent reply requiring a petition for an extension of time under this paragraph for its timely submission." 37 C.F.R. § 1.136(a)(3).*

NOTE: *"Amounts of twenty-five dollars or less will not be returned unless specifically requested within a reasonable time, nor will the payer be notified of such amounts; amounts over twenty-five dollars may be returned by check or, if requested, by credit to a deposit account." 37 C.F.R. § 1.26(a).*

- The Commissioner is hereby authorized to charge the following additional fees that may be required by this paper and during the entire pendency of this application to Account No. 18-0013.

- 37 C.F.R. § 1.492(a)(1), (2), (3), and (4) (filing fees)

WARNING: *Because failure to pay the national fee within 20 months without extension (37 C.F.R. § 1.494(b)(2)), results in abandonment of the application, it would be best to always check the above box.*

- 37 C.F.R. § 1.492(b), (c), and (d) (presentation of extra claims)

NOTE: *Because additional fees for excess or multiple dependent claims not paid on filing or on later presentation must only be paid or these claims cancelled by amendment, prior to the expiration of the time period set for response by the PTO in any notice of fee deficiency (37 C.F.R. § 1.16(d)), it might be best not to authorize the PTO to charge additional claim fees, except possibly when dealing with amendments after final action.*

- 37 C.F.R. § 1.17 (application processing fees)

- 37 C.F.R. § 1.17(a)(1)-(5)(extension fees pursuant to § 1.136(a).

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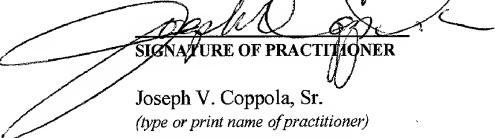
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- [] 37 C.F.R. § 1.18 (issue fee at or before mailing of Notice of Allowance, pursuant to 37 C.F.R. § 1.311(b)).

NOTE: Where an authorization to charge the issue fee to a deposit account has been filed before the mailing of a Notice of Allowance, the issue fee will be automatically charged to the deposit account at the time of mailing the notice of allowance. 37 C.F.R. § 1.311(b).

NOTE: 37 C.F.R. § 1.28(b) requires "Notification of any change in status resulting in loss of entitlement to small entity status must be filed in the application . . . prior to paying or at the time of paying . . . issue fee...." From the wording of 37 C.F.R. § 1.28(b): (a) notification of change of status must be made even if the fee is paid as "other than a small entity" and (b) no notification is required if the change is to another small entity.

- [x] 37 C.F.R. § 1.492(e) and (f) (surcharge fees for filing the declaration and/or filing an English translation of an International Application later than 20 months after the priority date.



SIGNATURE OF PRACTITIONER

Joseph V. Coppola, Sr.

(type or print name of practitioner)

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AP9472

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Hecker et al

Int'l Application No.: PCT/EP99/06236

Int'l Filing Date: 25/Aug/1999

Serial No.: Group Art Unit:

Filed: Herewith Examiner:

For: Method of Operating a Brake Assistant System

Attorney Docket No.: AP9472 Paper No.

Box PCT
Assistant Commissioner of Patents
Washington, D.C. 20231
Attn: ~~PO~~/US
DO

PRELIMINARY AMENDMENT

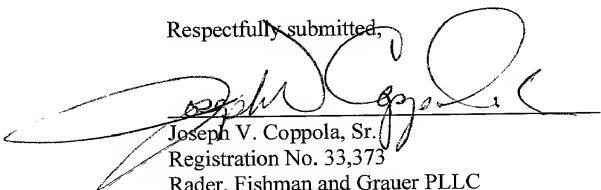
Dear Sir:

Please amend the application as follows prior to examination on the merits.

IN THE CLAIMS

Please cancel claims 2-9.

Respectfully submitted,


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CERTIFICATE OF MAILING

I hereby certify that the enclosed Preliminary Amendment is being deposited with the United States Postal Service on the date shown below with sufficient postage as Express Mail Post Office to Addressee mailing Label Number EL489900794US in an envelope addressed to the: Commissioner of Patents and Trademarks, Washington, D.C. 20231.

Date: 4/25/2000

By: Joyce Krumpe
Joyce A. Krumpe

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METHOD OF OPERATING A BRAKE ASSISTANT SYSTEM

The present invention relates to a method of operating a brake assistant system according to the preamble of patent claim 1.

In order to realize a shortest possible stopping distance of automobiles in emergency brake situations, it is necessary to excessively raise the brake pressure with respect to a pedal force initiated by the driver. Since studies have yielded the result that, in emergency brake situations, normal drivers often cannot or only with a delay induce the required pre-pressure, so-called "brake assistant systems" were developed which raise the brake pressure automatically above the level pre-determined by the driver.

In principle, there are three known systems. In a first one, the brake pressure is raised by means of an automatic control of the brake booster. In the second one, the active pressure raise occurs through suitable control of the ABS/ESP hydraulics by means of the electric return pump. Further on, there are other known brake assistant systems which all will be further developed. Just for example, it is referred to mechanical or electrical/mechanical brake assistants.

A method to shorten the stopping distance in critical driving situations has been disclosed in the German Patent DE 40 28 290 C1. In the method disclosed in this document, the excess of a first threshold value by the actuation speed of the brake pedal initiated by the driver is the criterion for the release of an automatic brake event, where, immediately after the release of the automatic brake event, such a brake pressure is automatically built up which corresponds to the value of the brake pressure at optimum vehicle deceleration. In order to ensure that the excessively raised brake pressure is reduced when the necessity of an automatic brake event is eliminated, it is verified, according to the teaching of this document, whether the actuation force of the brake pedal is smaller than a pre-set threshold value, i.e. whether the vehicle driver wants to reduce the power of the brake event and thus only a brake event with a lower brake force is necessary.

A mode of operation is provided which provides for the transition from a full pressure build-up of the actual brake assistant to a conventional brake behavior in order to avoid an abrupt termination of the support provided by the brake assistant which, immediately upon termination of the brake assistant, could have the result that a relatively low tandem master cylinder pressure coincides with a relatively high locking pressure.

Therefore, the objective of the present invention consists in avoiding the disadvantages of the prior art and in indicating a method of operating a brake assistant which avoids an abrupt termination of the brake support and which, at the same time, is particularly safe and user-friendly.

This objective is achieved in a method of the kind mentioned above my means of the features given in the characteristic portion of patent claim 1. Here, excess elevation is not understood as being the, regarding its absolute value, higher wheel cylinder pressure raised by the brake assistant with respect to the tandem master cylinder pressure, but it is rather the relative amount of this excess elevation with respect to the pressure in the tandem master cylinder.

A special advantage of the invention consists in that a once-initiated transition to conventional braking behavior is not being maintained for a longer time period. Otherwise, this would, e.g. while going downhill, result in an undesired and unsafe state of operation.

Preferably, the excess elevation is dependent on the driving situation and/or the input of a vehicle driver my means of the brake pedal. Thus, the brake force support can be tuned to the driving conditions in the best possible way. Also, in this case, a harmonic correlation can be ensured between the driver's directive and the pressure raise.

Preferably, the rate at which the excess elevation is reduced increases with the time duration and/or the intensity of a reduction of pedal force induced by the vehicle driver.

A reduction of pedal force indicates a driver's intention that a brake operation is not necessary or not necessary as forceful any more. The input control by the driver can be used in an advantageous way to design the transition of the brake assistant function to the conventional brake operation.

A particularly simple and cost-effective realization of the invention results from using a counting device to recognize whether and/or by what amount the driver reduces the pedal force.

In order to implement the invention, it is preferred if the momentary value of the wheel brake pressure results substantially from a multiplication of a current value of a time-dependent excess elevation function and the current value of the tandem master cylinder pressure.

And the excess elevation function, as a function of time, is monotonously descending.

Preferably, the excess elevation function descends in time segments in which the master cylinder pressure descends. Further, the excess elevation function is constant in time segments in which the tandem master cylinder pressure increases. Thus, every diminution of the induced brake force effects a reduction of the excess elevation, and every other input via the brake pedal affects the wheel brake pressure but not the excess elevation. In this way, the brake assistant support can be diminished unnoticeably for the driver.

According to a preferred enhancement of the invention, a momentary value of the excess elevation function depends on the previous course of the tandem master cylinder pressure. The consideration of the history of the tandem master cylinder pressure is particularly preferred for the estimate of the driving situation and of the driver's intention. Advantageously, the excess elevation function includes a pre-set maximum value. In this way, implausible excess elevations of the wheel brake pressure can be avoided.

The brake assistant system preferably changes over from the third mode of operation to the first mode of operation when the excess elevation function substantially occupies the value "1". In this case, the driver himself affords the required locking pressure and does not need any further support.

The invention as well as further advantages and embodiments of it will be explained subsequently by means of the attached drawings. Everywhere in the drawings, identical reference numerals stand for identical or corresponding sizes or elements, respectively. In the drawings,

Fig. 1 shows a schematic depiction of the course of the time-dependent tandem master cylinder pressure $p_{TMC}(t)$;

Fig. 2 shows a schematic depiction of a time-dependent excess elevation function $K(t)$ in order to illustrate an embodiment of the present invention; and

Fig. 3 shows a schematic depiction of the three modes of operation of the brake assistant system according to the invention and of the transitions between the respective states.

In Fig. 3, three kinds or modes of operation of the brake assistant system according to the invention are schematically depicted. From Fig. 3 can be obtained the function of the brake assistant system as an automaton of states. The first state or mode of operation "Passive" means that the brake assistant function is not active. As soon as an emergency braking situation is recognized, the system changes over into the second state or mode of operation "Total Pressure Build-up". In this state, a total pressure build-up is generated by means of a return pump and suitable control of separating and switch-over valves. From the state "Total Pressure Build-up", a change can be made as well into the state of passivity as into the third mode of operation, the dosage mode if the pedal force is significantly reduced which can be detected e.g. through the pressure

sensor device arranged in the tandem master cylinder. Higher-ranking criteria for the activation of the state "Dosage" out of the state "Total Pressure Build-up" are the recognition of a driver's intention of a dosed diminution of the brake force. This is sensed in case of a significant diminution of the tandem master cylinder pressure p_{TMC} after reaching the global locking-pressure level. A significant diminution of the tandem master cylinder pressure prior to reaching the global locking-pressure results in the direct transition from the state "Total Pressure Build-up" into the state "Dosage". In the state "Dosage", the brake force is modulated in dependence on the pedal force. After termination of the maximum actuation, the pressure build-up is gradually diminished or even increased again, in dependence on the driver's intention sensed by means of the measured tandem master cylinder pressure, in order to achieve in this way a comfortable transition between the maximum support during the emergency brake situation and the conventional brake behavior of the "Passive" mode after termination of the emergency brake support. This state resembles a brake-by-wire mode and can be called modulating.

In Fig. 1, a possible pressure course $p_{TMC}(t)$ of the tandem master cylinder pressure, substantially after the state "Total Pressure Build-up", is schematically depicted. The tandem master cylinder pressure $p_{TMC}(t)$ is, due to the actuation of the brake assistant function, significantly smaller than the wheel brake pressure(not depicted). The possible pressure course $p_{TMC}(t)$ schematically depicted in Fig. 1 is the result of an input by the driver by means of actuation of a brake pedal. In Fig. 1 can be seen that the tandem master cylinder pressure $p_{TMC}(t)$ is substantially constant between a point in time t_0 and t_1 . This means that $p_{TMC}'(t) = 0$ in the interval from t_0 to t_1 . Between the point in time t_1 and a point in time t_2 , the tandem master cylinder pressure decreases continuously. At the point in time t_2 , the tandem master cylinder pressure $p_{TMC}(t)$ reaches a minimum value $p_{TMC}(t_2)$. Between the point in time t_2 and a point in time t_3 , the tandem master cylinder pressure $p_{TMC}(t)$ increases continuously. At the point in time t_4^\ominus , the master cylinder pressure has a maximum value $p_{TMC}(t_4^\ominus)$. Between the point in time t_3 and a point in time t_4 , the master cylinder pressure decays continuously. At the point in time t_4 ,

the tandem master cylinder pressure $p_{TMC}(t)$ has a minimum value $p_{TMC}(t_4)$. In this example, the master cylinder pressure rises anew as of the point in time t_4 .

^④Translator's note: "t₄" should read "t₃"

According to the present invention, the excess elevation of the brake force caused by the automatic brake assistant shall be successively diminished. A diminution according to a simple time-dependent function, however, yields the disadvantage that the behavior of the system goes beyond the driver's understanding. This is the case, for instance, when the brake effect fades despite keeping the pedal force constant. According to the invention, the vehicle deceleration or the wheel brake pressure $p_{WHEEL}(t)$, respectively, are controlled dependent on a measured tandem master cylinder pressure $p_{TMC}(t)$ during the dosage phase. A sample course of $p_{TMC}(t)$ was described above in connection with Fig. 1. A possible functional correlation for controlling the wheel brake pressures $p_{WHEEL}(t)$ is: $p_{WHEEL}(t) = K(t) * p_{TMC}(t)$. This functional correlation is just given as an example and serves in particular also to define the excess elevation function $K(t)$ insofar as estimated values or currently measured values, respectively, are used. It is noted that, in particular also in the above equation, an offset can be considered, i.e. in particular of the kind $[p_{WHEEL}(t) - x \text{ bar}] = K(t) * [p_{TMC}(t) - x \text{ bar}]$. If the value or x , for example, amounts to 6, the third mode of operation can be exited into the passive mode when the tandem master cylinder pressure falls below a minimum pressure of 6 bar. The course of the time-dependent excess elevation function $K(t)$, which can also be called amplification factor, is, according to a variant of the present invention, schematically depicted in Fig. 2. From Fig. 2, it can be gathered that $K(t)$ has a monotonously declining course. The value of $K(t)$ ranges between a substantially maximum starting value for the dosage mode which is substantially determined according to the proportion between an estimated locking-pressure level and the current tandem master cylinder. In principle, a maximum value for $K(t)$ is pre-set, e.g. 3.5, in order to avoid implausible wheel brake pressure excess elevations. During the entire dosage mode, the value of $K(t)$ is greater than 1, for otherwise no further brake support is required and the system changes into the passive mode. In the embodiment shown, the course of $K(t)$ is not strictly monotonous, for there are times when $K'(t)$ equals 0.

Substantially, the rule is that, in phases in which the tandem master cylinder pressure $p_{TMC}(t)$ is constant or rises, that means in phases in which $p_{TMC}'(t)$ is greater than or equal to 0, $K(t)$ is constant. Substantially in phases in which $p_{TMC}(t)$ declines, i.e. when $p_{TMC}'(t)$ is smaller than 0, $K(t)$ declines as well, i.e. $K'(t) < 0$. In Fig. 2 can be seen that, in the interval from t_0 to t_1 , $K(t)$ is substantially constant. In the interval from t_1 to t_2 , $K(t)$ declines substantially monotonously to a value $K(t_2)$. In the interval from t_2 to t_3 , $K(t)$ is substantially constant. In the interval from t_3 to t_4 , $K(t)$ declines substantially monotonously. As of the point in time t_4 , $K(t)$ is constant for all $t > t_4$. Therefore, the course of $K(t)$ is substantially a sequence of declining plateaus corresponding to the oscillations of the tandem master cylinder pressure $p_{TMC}(t)$. The plateaus themselves are substantially characterized by phases of rising tandem master cylinder pressure $p_{TMC}(t)$. The plateaus, which, with time increasing, have declining values, are connected by monotonously declining line segments which substantially correspond to phases of declining tandem master cylinder pressure $p_{TMC}(t)$. It is noted that, according to the depicted and described embodiment of the invention, the brake assistant support is diminished practically undetectably by the driver. Advantageously, the rate at which the support of the hydraulic brake assistant is diminished, i.e. in particular the derivative $K'(t)$, increases according to its absolute value the longer and the more distinctly the driver diminishes the pedal force. This means graphically, particularly in the embodiment, that, if the interval, e.g. between t_1 and t_2 increased, i.e. if the driver diminished the pedal force over a longer time interval, the inclination of $K(t)$ would increase. Accordingly, the same is true if the diminution of pedal force, i.e., for instance, the value of $p_{TMC}(t_2)$ minus $p_{TMC}(t_3)$ increased.

List of Reference Numerals

P_{TMC}	Tandem master cylinder pressure
P_{WHEEL}	Wheel brake pressure
K	Excess elevation function
T	Time

Patent Claims

1. A method of operating a brake assistant system which comprises a first mode of operation in which the brake assist system is not actuated, a second mode of operation in which after recognition of an emergency brake situation a pressure build-up of wheel brakes is generated, and a third mode of operation which is provided for the transition from the second into the first mode of operation, the wheel brake pressure (p_{wheel}) in the third mode of operation being excessively elevated compared to the tandem master cylinder pressure (p_{TMC}) in a remote-controlled way, **characterized in that** the amount of excess elevation is monotonously diminished in the course of time.

2. A method according to claim 1, **characterized in that** the excess elevation depends on the driving situation and/or the input of a vehicle driver via the brake pedal.

3. A method according to claim 2, **characterized in that** the rate at which the excess elevation is diminished is the greater the greater the time duration and/or the intensity of a diminution of pedal force by the driver is.

4. A method according to claim 3, **characterized in that** for the recognition of whether and/or by which amount the driver diminishes the pedal force, a counter device is used.

5. A method according to one of the preceding claims, **characterized in that** the momentary value of the wheel brake pressure (p_{WHEEL}) substantially results from a multiplication of a momentary value of a time-dependent excess elevation function ($K(t)$) and the momentary value of the tandem master cylinder pressure (p_{TMC}).

6. A method according to one of the preceding claims, **characterized in that** the excess elevation function ($K(t)$) is monotonously declining as a function of time.
7. A method according to one of the preceding claims, **characterized in that** the excess elevation function ($K(t)$) is declining in time intervals in which the tandem master cylinder pressure (p_{TMC}) is declining.
8. A method according to one of the preceding claims, **characterized in that** the excess elevation function ($K(t)$) is constant in time intervals in which the tandem master cylinder pressure (p_{TMC}) is increasing.
9. A method according to one of the preceding claims, **characterized in that** a momentary value of the excess elevation function ($K(t)$) depends on the previous course of the tandem master cylinder pressure (p_{TMC}).

Abstract

In a method of operating a brake assistant system which includes a first mode of operation in which the brake assistant system is not operated, a second mode of operation in which, after recognition of an emergency brake situation, a pressure build-up of wheel brakes is generated, and a third mode of operation which is provided for the transition from the second into the first mode of operation, wherein in the third mode of operation the wheel brake pressure (p_{WHEEL}) is excessively elevated compared to the tandem master cylinder pressure (p_{TMC}) in a remote-controlled way, a particularly safe and user-friendly termination of the brake assistant system results from diminishing the amount of the excess elevation monotonously over the course of time.

(Fig. 3)

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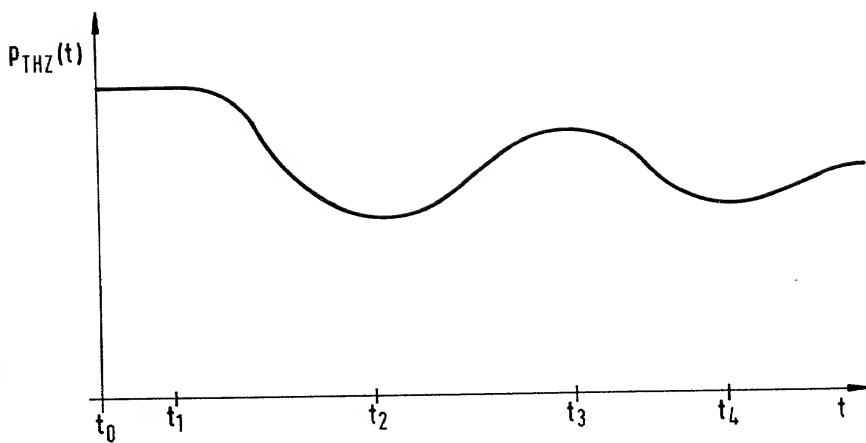


Fig. 1

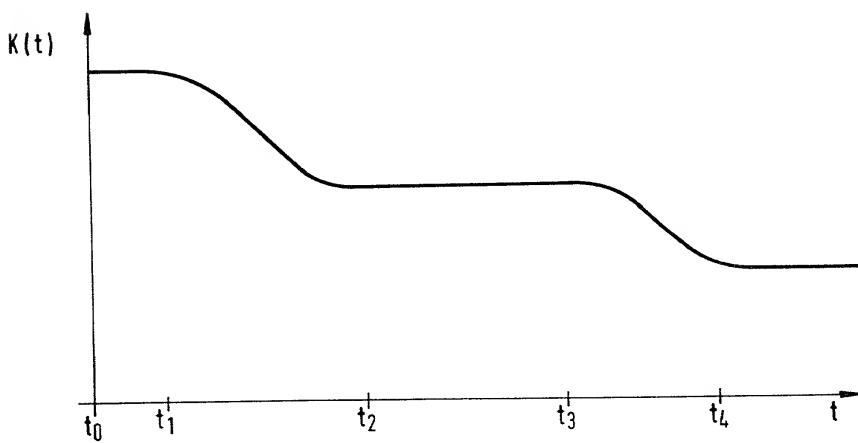


Fig. 2

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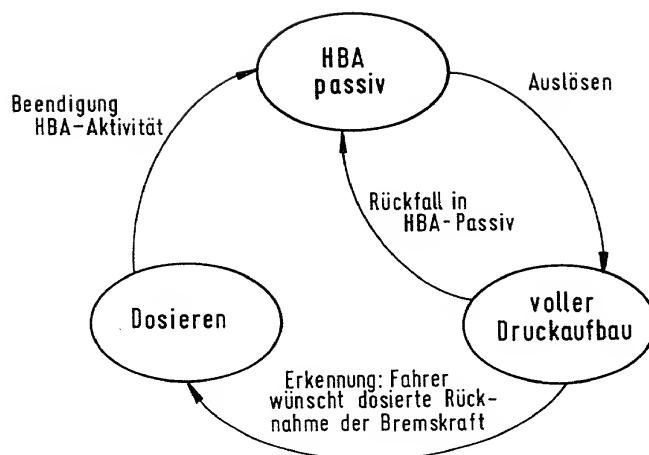


Fig. 3

AP9472

Declaration and Power of Attorney for Patent Application

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I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

Method of Operating Braking Assisted Systems

the specification of which is attached hereto unless the following box is checked:



was filed on **August 25, 1999**
as United States Application Number or PCT
International Application Number **PCT/EP99/06236**

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above and as amended in a preliminary amendment.

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[Page 1 of 3]

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Prior Foreign Applications
(Frühere ausländische Anmeldungen)

Priority Not Claimed
Priorität nicht beansprucht

198 38 618.4 Germany

25/August/1998

Number Country

Day/Month/Year Filed

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